

**TIMELY TOPICS**

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# Current and emerging strategies for nutritional management of dry and fresh cows

**N**utritional management strategies for transition cows have evolved significantly over the past ten years in the dairy industry, and ongoing research and experience continue to refine our recommendations. Our high performing herds combine high milk production with modest loss of body condition score (no more than 0.5 or so units during early lactation), low incidence of metabolic and immune function-related diseases, excellent reproductive performance during early lactation, and have calves born alive and ready to thrive. This article outlines current recommendations and highlights ongoing areas of research interest.

**High performing herds combine high milk production with excellent health by maximizing nutrition.**

prepartum DCAD, and can also provide valuable information about feeding management. Urine pH should be measured in midstream urine samples from approximately 12 to 15 cows weekly, ideally at about the same time postfeeding. Large variation from cow to cow within a week suggests that inadequate feeding management or grouping factors, such as overcrowding, is leading to sorting of the TMR. Variation in average urine pH from week to week can indicate inconsistency in ration mixing or changes in feed ingredient

composition.

## Feeding strategies for the dry cow

### *Management of hypocalcemia – an old topic made new again*

Clinical milk fever is a thing of the past on many dairies.

However, even in herds with very low milk fever incidence, subclinical hypocalcemia (SCH) after calving can affect 50% or more of the herd, which predisposes cows to infectious and metabolic disease and reduces their productive and reproductive potential. The need to employ strategies to reduce SCH incidence is becoming more evident. Reducing the dietary cation anion difference (DCAD;  $\text{Na} + \text{K} - \text{Cl} - \text{S} = \text{mEq}/100 \text{ g DM}$ ) of the prepartum ration is a tried and true method to decrease rates of clinical milk fever. However, strategies for implementation in the field vary widely.

Recent research in our group at Cornell aimed to determine if calcium status and performance improved as DCAD decreased by increasing feeding rates of an anionic supplement. Three experimental groups included a low potassium control ration (+18.3 mEq/100 g DM), partial anion supplementation (+5.9 mEq/100 g DM) and full anion supplementation (-7.4 mEq/100 g DM). Diets were managed to maintain urine pH of the fully supplemented group between the target of 5.5 to 6.0. As prepartum DCAD was decreased in this trial, average postpartum plasma calcium was increased, especially in older (3+ lactation) cows, postcalving dry matter intakes (DMI) increased by about 3 lbs/day and milk yield increased by about 7 lbs/day for cows fed the full DCAD approach. This study indicates that implementing a more aggressive DCAD prepartum yields the greatest benefits postpartum compared to a low K only approach.

Measuring urine pH is an essential component of monitoring

## Dry period plane of energy and effects on health, production, and reproduction

Since the early 2000's, the historically proposed "steam up" approach to dry cow feeding has largely been abandoned. With increasing evidence from research conducted at the University of Illinois, among others, a controlled energy strategy to feeding dry cows was proposed. Lower postpartum concentrations of non-esterified fatty acids (NEFA) and ketone bodies (e.g.  $\beta$ -hydroxybutyrate or BHB) were observed with these controlled energy diets and the incidence of metabolic disease was decreased. However, some studies suggested decreased postcalving milk production, particularly in those with very low energy densities in the ration. Relatively little attention was paid to controlling for adequate metabolizable protein (MP) supply when controlling energy intake.

Cornell research investigated the effects of three different dietary energy strategies during the dry period. A bulky, high fiber controlled energy diet (approximately 100% of energy requirements), a high energy diet (approximately 150% of energy requirements), and a step-up approach where the controlled energy diet was fed during the first 28 days after dry off, after which cows were fed an intermediate diet (approximately 125% of energy requirements) for the remainder of the dry period (28 days before expected calving). All diets were fed ad libitum and predicted MP supply was formulated for approximately 1,300 g/d. Our observations confirmed that feeding a controlled energy diet prepartum was associated with lower postpartum concentrations of markers of negative energy balance, such as NEFA and BHB whereas milk production was not different between the groups. In addition, as previously observed by others, glucose and insulin concentrations remained higher postpartum in

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the controlled energy group. This is of great importance for the fresh cow as glucose is necessary for normal immune cell function and insulin prevents excessive breakdown of adipose and muscle tissue due to its direct inhibitory effects on these processes.

## Effects of dry period plane of energy on colostrum composition

Most of the research on the effect of prepartum diet on colostrum composition of cattle stems from research in beef cattle. Few studies have evaluated the effect of feeding dairy cows either a controlled or higher energy diet on colostrum quality and quantity while controlling for adequate protein supply. Our research showed that cows fed a controlled energy diet for the whole duration of the dry period (approximately 57 days) had a greater concentration of IgG in colostrum (96 g/L) than those fed a higher energy diet (72 g/L) during the dry period. At the same time colostrum volume was not significantly different (13 vs. 16 lbs). Higher concentrations of IgG in colostrum allow for a higher amount of antibodies to be administered to the calf in one feeding which we consider beneficial for passive transfer of immunity. In our opinion, and according to experience shared by others, it is important to allow for an adequate supply of MP prepartum while controlling the diet for energy to prevent a drop in colostrum volume. Our current recommendation for an adequate protein supply during the prepartum period is 1,200 to 1,400 g/d of predicted MP. Particularly with controlled energy diets, adequate sources of RUP should be included in the diets to achieve this goal. No beneficial effects on postpartum performance or health have been observed when higher than recommended amounts of MP were fed.

## Feeding management of dry cow rations

Even the best formulated rations will not be effective if they are not well-implemented. Bulky rations with the forage base consisting of either straw or mature, low potassium hay blended with corn silage and a grain mix can be easily sorted by cows if the straw or hay is not chopped, ideally prior to mixing into the TMR. In new research conducted by our group and involving 72 commercial dairy farms in New York and Vermont, only 25% of the prefresh TMR had particle size within recommended ranges (10 to 20% on the top screen; 50 to 60% in the middle; < 40% in the pan) using the Penn State Particle Separator (PSPS). We recommend chopping the straw or hay such that the long particles are no more than 1.5 inches (33% on each of the three sections of the PSPS). Often, addition of water or another wet ingredient to decrease the ration dry matter into the 46 to 48% range is also required for optimal effectiveness of these rations. Accuracy and consistency in feed delivery and composition are paramount to a successful transition feeding program.

## Emerging concepts in feeding the fresh cow

Ironically, the vast majority of transition cow nutritional management research conducted over the past 20 plus years has focused almost exclusively on the dry cow. Fresh cow rations are common in the dairy industry, although often they are modest variations of the high cow ration, perhaps with slightly higher fiber content and/or the inclusion of modest amounts (1.5 lbs or less) of straw or hay, lower starch content, additional rumen undegradable protein, increased amounts of supplemental fat, or targeted inclusion of other nutrients

or additives (e.g., rumen-protected choline, additional yeast or yeast culture, additional monensin).

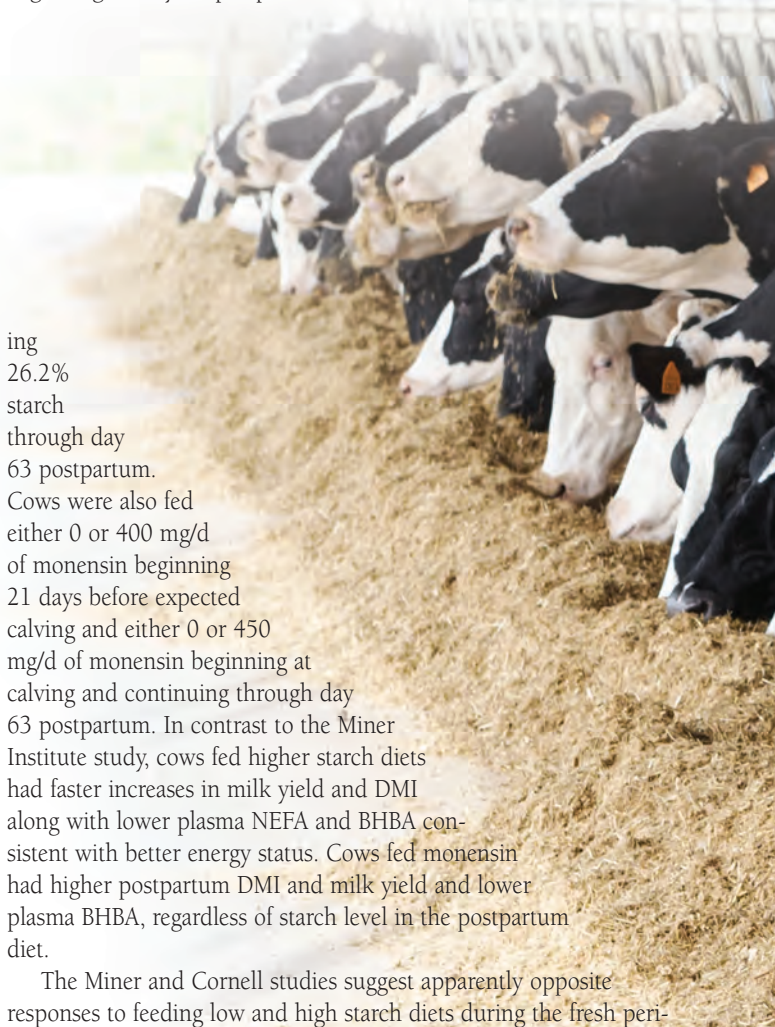
## Starch and fiber interactions during the precalving and postcalving periods

The research groups at Cornell and Miner Institute have completed three experiments evaluating starch content of the postpartum diet and starch content of the postpartum diet and monensin supplementation throughout the periparturient period. In a study conducted by Miner Institute, Holstein cows were fed a controlled energy diet during a shortened (40 day) dry period and then one of three dietary starch regimens during early lactation – a low starch (21.0% starch) diet for the first 91 days postpartum, a medium starch (23.2% starch) diet for the first 21 days postpartum followed by a high starch (25.5% starch) diet through 91 days postpartum, and a high starch diet (25.5% starch) for the first 91 days postpartum. Cows fed the low starch and medium-high starch diets after calving had similar DMI and performance postcalving whereas cows fed the higher starch diet postcalving had lower DMI and lower milk yield.

At Cornell, we fed Holstein cows diets containing either 26.2% or 21.5% starch from calving through days 21 postpartum. Beginning on day 22 postpartum all cows were fed the diet contain-

ing 26.2% starch through day 63 postpartum. Cows were also fed either 0 or 400 mg/d of monensin beginning 21 days before expected calving and either 0 or 450 mg/d of monensin beginning at calving and continuing through day 63 postpartum. In contrast to the Miner Institute study, cows fed higher starch diets had faster increases in milk yield and DMI along with lower plasma NEFA and BHBA consistent with better energy status. Cows fed monensin had higher postpartum DMI and milk yield and lower plasma BHBA, regardless of starch level in the postpartum diet.

The Miner and Cornell studies suggest apparently opposite responses to feeding low and high starch diets during the fresh peri-





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od. However, in the Miner study, cows were fed a typical low starch (13.5%), controlled energy diet for the entire 40 day dry period whereas in the Cornell study, cows were fed a moderate starch close up diet (17.4%). Based upon these results, we speculate that the differences in starch levels between precalving and postcalving diets should be no more than 8 to 10 percentage units.

Based upon some case study work as part of a controlled experiment during Dr. Maris McCarthy's Ph.D. research at Cornell, we also speculate that there are interactions between starch and fiber levels in the postcalving diet. When physically effective fiber in the fresh diet was insufficient, DMI was higher for cows fed a lower starch diet. However, when straw was increased to levels higher than typical (~ 11% of diet dry matter compared to typical 2 to 4%), DMI was higher for cows fed the higher starch diet. We are currently following up this work with controlled research to further understand the role of fiber in the fresh cow ration.

### Additional requirements for metabolizable protein and amino acids in fresh cows?

In addition to being in negative energy balance, cows also are in negative protein balance during early lactation. This negative protein balance reaches its low point at about 7 days after calving, and cows

likely reach positive protein balance by about 21 days after calving. Cows compensate for this negative protein balance in part by mobilizing body protein postcalving, although this process is much less than mobilization of body fat during early lactation.

Recently, researchers in Denmark employed an innovative experimental approach where they estimated the negative MP balance in cows during the postpartum period and then infused casein into the abomasum in order to eliminate the deficit in MP. Although the number of cows in this experiment was very small ( $n = 4$  per treatment), cows infused with casein produced about 16 lbs per day more milk than controls during the experimental period. Further research is needed to evaluate cow responses to supplies of both total MP and individual AA during the postpartum period. □

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